REMARKS

Claims 1-18 are pending in the present application. Claims 11-18 are withdrawn from consideration.

Claims 1-4 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hirsch (U.S. Patent Nr. 5,527,379) in view of Hiltunen (U.S. Patent No. 5,505,907). Claims 1-6 were provisionally rejected on the ground of nonstatutory obviousness type double patenting as being unpatentable over claims 1-29 of co-pending Application No. 10-540,435. Claims 1-7 and 9 were provisionally rejected on the ground of nonstatutory obviousness type double patenting as being unpatentable over claims 1-20 of co-pending Application No. 10-540,376 in view of Hirsch. Claims 1-6 and 15 were provisionally rejected on the ground of nonstatutory obviousness type double patenting as being unpatentable over claims 1-24 of co-pending Application No. 10-540,438 in view of Hirsch.

Claim 1 has now been amended. No new matter has been added. Reconsideration of the application in view of the above amendments and below remarks is respectfully requested.

Nonstatutory Obviousness-Type Double Patenting Rejections

Claims 1-6 were provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-29 of co-pending Application No. 10-540,435. Claims 1-7 and 9 were provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-20 of co-pending Application No. 10-540,376 in view of Hirsch. Claims 1-6 and 15 were provisionally rejected on the ground of nonstatutory obviousness type double patenting as being unpatentable over claims 1-24 of co-pending Application No. 10-540,438 in view of Hirsch.

Terminal disclaimers under 37 C.F.R. 1.321 have been submitted herewith to overcome the provisional nonstatutory obviousness type double patenting rejections. It is respectfully submitted that the provisional nonstatutory obviousness-type double patenting rejections are now moot in view of these filings.

Reconsideration and withdrawal of the provisional nonstatutory obviousness-type double patenting rejections is respectfully requested.

Rejections of Claims 1-4 under 35 U.S.C. § 103(a)

Claims 1-4 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hirsch (U.S. Patent Nr. 5,527,379) in view of Hiltunen (U.S. Patent No. 5,505,907). It is noted that dependent claims 5-10 were not explicitly rejected under 35 U.S.C. §103(a), although these claims were addressed under the 35 U.S.C. §103(a) rejection based on Hirsch in view of Hiltunen.

Hirsch describes a process for a direct reduction of iron oxide containing materials using a conventional fluidized 22 bed with a recirculation 42 of hot reducing gas. See Hirsch, column 8, lines 2-11, and Fig. 1.

Hiltunen describes a method and apparatus for cooling hot gas in a reactor. Hiltunen describes a reactor 10 where the lower section is provided with a hot gas inlet 16 and a chamber encompassing a fluidized bed 14, the middle section is provided with a riser 22, and the upper section with a cooled gas outlet 30. Heat is transferred from the hot gas to solid particles inlet top edges 18. Heat is recovered from the solid particles at the cooling panels 24 and at transfer surfaces 46 and 44. Two conduits 54 and 56 regulate the volume of the particles. See Hiltunen, column 1, lines 39-61, and Fig. 1.

Independent claim 1 of the present application recites "adjusting the gas velocities of the first gas or gas mixture as well as of the fluidizing gas for the annular fluidized bed such that the particle Froude numbers in the gas supply tube are between 1 and 100, in the annular fluidized bed between 0.02 and 2 and in the mixing chamber between 0.3 and 30."

It is respectfully submitted that neither Hirsch nor Hiltunen teach or suggest adjusting the gas velocities such that the particle Froude numbers in the gas supply tube are between 1 and 100, in the annular fluidized bed between 0.02 and 2 and in the mixing chamber between 0.3 and 30, as recited in claim 1. In contrast, Hirsch merely describes a typical Froude number range for a circulating fluidized bed reactor that may define overall reactor operating conditions. See Hirsch, column 3, lines 23-45. Hirsch nowhere teaches establishing differing Froude ranges in different portions of the chamber of an annular fluidized bed reactor, i.e., the gas supply line, annular

fluidized bed and mixing chamber, as recited in claim 1. Nor does Hirsch teach the combination of Froude number ranges recited in claim 1. Regarding Hiltunen, that reference does not teach Froude numbers at all. Nor could Froude numbers have been defined for the inhomogeneous flow conditions in the Hiltunen reactor. In Hiltunen, particles flowing back to the fluidized bed release heat to the cooled walls 24 of the riser 22. See Hiltunen, column 4, lines 47-50, and Fig. 1. Local cooling of the suspension in the riser 22 leads to increased local densities and decreased volume flow. The particles close to the wall therefore sink down as is indicated in Hiltunen by the arrows in Figs. 1-3; i.e., the downward arrows next to wall 24. The flow characteristics in the Hiltunen reactor are therefore achieved through flow directions caused by the temperature profile of the reactor. Such flow directions can only be realized if relatively high temperature gradients exist in the reactor, unlike the conditions in the stationary annular fluidized bed recited in claim 1 of the present application. See Hiltunen, column 3, lines 10-13, and column 4, lines 39-40. Due to the inhomogeneous flow environment, the process conditions in the Hiltunen reactor cannot be characterized by certain particle Froude numbers. A person of ordinary skill in the art would therefore not have attempted to apply Froude numbers to control the reactor of Hiltunen.

Because each of Hirsch and Hiltunen are missing at least the recited differing Froude ranges feature recited in claim 1, it is respectfully submitted that any combination of Hirsch and Hiltunen, to the extent proper, could not render claim 1 or any of its dependent claims obvious.

Moreover, independent claim 1 of the present application has now been amended so as to recite a method for the heat treatment of solids containing iron oxide including "introducing the solids into the reactor" of a "stationary annular fluidized bed" reactor "and removing the treated solids from the reactor." Support for this amendment can be found in the Specification, for example, on page 7, line 32 to page 8, line 1, page 8, lines 10 to 13, page 9, lines 3 to 8, and page 9, line 28, to page 10, line 5.

It is respectfully submitted that it would not have been obvious to combine the reactor technology of Hiltunen with the iron oxide reduction process of Hirsch so as to provide heat treatment of solids including introducing the solids into the reactor of a stationary annular fluidized bed reactor and removing the treated solids from the reactor, as recited in amended claim 1. Hiltunen describes a reactor which is used to cool gas by repeatedly heating and cooling the same

particles. See Hiltunen, the abstract, column 1, lines 7-8 and column, 3, lines 5-11. In Hiltunen, no treated solid material is removed from the reactor; the particles are merely recirculated. See, Hiltunen, column 2, lines 31 to 42, column 3, lines 36 to 47, and column 4, lines 39 to 61. Hiltunen's two conduits 54 and 56 are merely used for volume regulation. See Hiltunen, column 5, lines 2-4.

It is respectfully submitted that a person of ordinary skill in the art would not have attempted to incorporate the stationary annular fluidized bed configuration of Hiltunen into the reactor system of Hirsch. Such a combination would require a significant redesign of the Hirsch system because the Hirsch system has an entirely different purpose that the Hiltunen reactor—to heat particles so as to produce treated solid product versus to recirculate and cool particles so as to cool a gas. Hirsch requires recirculation of particles *outside* the reactor to recycle cyclone 24 in order to produce the solid product. See Hirsch, column 7, lines 50-53. Hiltunen, in contrast, recirculates particles *inside* the reactor through particle separator 28 and downward through return duct 36 with the express purpose of cooling a gas. See Hiltunen, column 4, lines 46-61. As noted above, Hiltunen does not produce solid product at all. The incorporation of the Hiltunen reactor technology into the Hirsch system would result in the entire function of the Hirsch system being changed. Alternatively, if the Hirsch system were not so redesigned, the technology described in Hiltunen would require a significant redesign to work in the Hirsch system because Hiltunen merely recirculates the particles within the reactor with no product being produced. Indeed, the entire purpose of Hiltunen is different—to cool gas rather than to produce particles, as in Hirsch. The cooling wall panels 24 of particle separator 28 and the heat transfer surfaces 44 and 46 of Hiltunen are directed at cooling and separating recirculated particles so as to cool gas. These panels and heat transfer surfaces would cool the particles and cause inhomogeneous flow conditions in the reactor, as discussed above, thereby preventing the Hiltunen technology from functioning in the system of Hirsch to heat the particles and produce solid material product. A person of ordinary skill in the art would therefore have been motivated *away* from attempting to incorporate the Hiltunen technology into the Hirsch system.

For the above reasons, reconsideration and withdrawal of the rejection to claims 1-4 under 35 U.S.C: § 103(a) based on Hirsch in view of Hiltunen is respectfully requested.

CONCLUSION

It is respectfully submitted that the application is in condition for allowance.

The Commissioner is hereby authorized to charge any unpaid fees deemed required in connection with this submission, including any additional filing or application processing fees required under 37 C.F.R. §1.16 or 1.17, or to credit any overpayment, to Deposit Account No. 04-0100.

Dated: March 17, 2009

Respectfully submitted,

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